

Serial No. 09/456,184

Amendments to the claims are presented herein by presenting a set of pending claims, as amended, in clean form. Also, an Appendix entitled "Version With Markings to Show Changes Made," showing the current amendments to the claims is attached hereto.

Please amend the above-identified application as follows:

IN THE CLAIMS:

Please replace the previous version of the claims with the following clean version, wherein claims 17 and 19 incorporate new amendments thereto, and claims 7-16 have been cancelled herein. Claim 20 has been represented for clarity and now correctly includes the originally present, non-deleted word, "the", inadvertently left out of the last clean version of the claims presented in the previous amendment.

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1. A driving apparatus for driving a piezoelectric element serving as a driving source of an actuator comprising:

a waveform generator for generating a waveform signal varying over time;

a first driver for generating a first driving signal, wherein the first driving signal has a maximum voltage smaller than a voltage of inversion of polarization of the piezoelectric element and has a waveform derived from the waveform signal, the first driver being coupled to provide the first driving signal to the piezoelectric element in the polarization direction of the piezoelectric element; and

a second driver for generating a second driving signal, wherein said second driving signal has a maximum voltage smaller than the voltage of inversion of polarization of the piezoelectric element and has a waveform derived from the waveform signal, the second driver being coupled to provide the second driving signal to the piezoelectric element in a direction opposite to the polarization direction.

2. A driving apparatus in accordance with claim 1, wherein the second driving signal has a waveform which is an inversion of a waveform of the first driving signal.

3. A driving apparatus in accordance with claim 1, wherein the waveforms of the first and second driving signals are sine waves.

4. A driving apparatus in accordance with claim 1, wherein the waveforms of the first and second driving signals are sawtooth waves in which the inclination in a rising portion is different from that in a falling portion.

5. A driving apparatus in accordance with claim 1, wherein the first driver and the second driver respectively include an amplifier for amplifying the signal from the waveform generator.

6. A driving apparatus in accordance with claim 1, wherein the actuator is an impact type actuator comprising a first unit with the piezoelectric element and a second unit slidably held on and relatively movable against the first unit.

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17. (Twice Amended) A driving apparatus for driving a piezoelectric element serving as a driving source of an actuator comprising:

a first driver for applying a first time varying driving signal to the piezoelectric element in a polarization direction thereof; and

a second driver for applying a second time varying driving signal to the piezoelectric element equal to or smaller than a voltage of inversion of polarization of the piezoelectric element in a direction opposite to the polarization direction.

18. A driving apparatus in accordance with claim 17 further comprising an electric power supply for supplying electric power to the first and second drivers.

19. (Once Amended) A driving apparatus for driving a piezoelectric element serving as a driving source of an actuator comprising:

a first driver for applying a first driving signal to the piezoelectric element in a polarization direction thereof;

a second driver for applying a second driving signal to the piezoelectric element equal to or smaller than a voltage of inversion of polarization of the piezoelectric element in a direction opposite to the polarization direction;

an electric power supply for supplying electric power to the first and second drivers; and

a waveform generator for generating a time varying signal, wherein only the first driver applies the first driving signal corresponding to the waveform of the time varying signal when the time varying signal is larger than a predetermined level; and wherein both of the first and second driving signals correspond to the time varying signal when the time varying signal is smaller than the predetermined level.

20. (Once Amended) A driving apparatus in accordance with claim 19, wherein the first and second driving signals are 0V when the time varying signal is equal to the predetermined level.

21. A driving apparatus in accordance with claim 19, wherein the waveforms of the first and second driving signals are sine waves.

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22. A driving apparatus in accordance with claim 19, wherein the waveforms of the first and second driving signals are sawtooth waves in which the inclination in a rising portion is different from that in a falling portion.

23. A method for driving an actuator having a piezoelectric element serving as a driving source characterized by that:

a first driving signal having a maximum voltage smaller than a voltage of inversion of polarization of the piezoelectric element is applied to the piezoelectric element in a polarization direction; and

a second driving signal having the same voltage but the inverted polarization is applied to the piezoelectric element in a direction opposite to the polarization direction of the piezoelectric element.

24. A method in accordance with claim 23, wherein the second driving signal has a waveform which is an inversion of a waveform of the first driving signal.

25. A method in accordance with claim 23, wherein the waveforms of the first and second driving signals are sine waves.

26. A method in accordance with claim 23, wherein the waveforms of the first and second driving signals are sawtooth waves in which the inclination in a rising portion is different from that in a falling portion.
